

- 10) Δ inc temp (GAY LUSAC)
 Δ inc KE
 more wall collisions
 more pressure

- b) See vol (BOYLE)
 particles move in smaller space
 more wall collisions
 more pressure

- c) perfume molecules randomly
 collide with air molecules
 perfume molecules slowly
 move throughout the room

- d) bullet moves in a
 straight line over
 a long distance
 while the perfume
 moves only a short
 distance before
 colliding with air
 and changing direction

$$n_{H_2} = 7.50 \text{ mol} \times \frac{24.8 \text{ L}}{1 \text{ mol}} = 186 \text{ L}$$

$$n_{SO_2} = 50 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{1 \text{ mol}}{24.8 \text{ L}} = 0.002 \text{ mol} = 2.0 \text{ mmol}$$



Figure 6.10
 When an electric current is passed through a glass tube containing the noble gas, neon, the gas glows a characteristic red colour.

EXAMPLE

What volume is occupied by 0.024 mol of carbon dioxide gas at SATP?

$$V_{CO_2} = 0.024 \text{ mol} \times \frac{24.8 \text{ L}}{1 \text{ mol}} = 0.60 \text{ L}$$

Exercise

10. Use the kinetic molecular theory to explain the following observed properties of gases.

- Gas pressure increases when the volume of the gas is kept constant and the temperature increases.
- Gas pressure increases when the temperature is kept constant and the volume of the gas decreases.
- The fragrance of an open bottle of perfume is evident throughout a room.
- At SATP, the average speed of air (oxygen and nitrogen) molecules is about 450 m/s, which is approximately the speed of a bullet fired from a rifle. Nevertheless, it takes several minutes for the odor of a perfume to diffuse throughout a room.

11. Weather balloons filled with hydrogen gas are occasionally reported as UFOs. They can reach altitudes of about 40 km. What volume does 7.50 mol of hydrogen gas in a weather balloon occupy at SATP?

12. Sulfur dioxide gas is emitted from marshes, volcanos, and refineries that process crude oil and natural gas. What amount of sulfur dioxide is contained in 50 mL of the gas at SATP?

13. Neon gas under low pressure emits the red light that glows in advertising signs (Figure 6.10). What volume does 2.25 mol of neon gas occupy at STP before being added to neon tubes in a sign?

14. Oxygen is released by plants during photosynthesis and is used by plants and animals during respiration. What amount in moles of oxygen is present in 20.0 L of air at STP? Assume that air is 20% oxygen (by volume).

$$n_{O_2} = 20.0 \text{ L} \times \frac{20}{100} \times \frac{1 \text{ mol}}{22.4 \text{ L}}$$

$$= 0.179 \text{ mol} = 179 \text{ mmol}$$

Molar Volume and Molar Mass

Gases such as oxygen and nitrogen are often liquefied for storage and transportation, then allowed to vaporize for use in a technological application. Helium is stored and transported as a compressed gas. Both liquefied and compressed gases are sold by mass. Molar volume and molar mass can be combined to calculate the volume of gas that is available from a known mass of a substance.

$$\rightarrow n_{Ne} = 2.25 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 50.4 \text{ L}$$